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Diseases of Canola

Diseases affect the pods, stems, leaves and roots of canola crops grown in Alberta every year and occasionally cause serious losses to the producer. Different diseases can attack the crop at any time from seeding to maturity. Disease severity varies with the year and location, and is greatly influenced by farming practices and weather conditions. By learning to recognize canola diseases and identify those that are economically important, disease management practices can be undertaken to reduce losses. This factsheet is intended to aid in the identification and management of canola diseases in Alberta.

Seedling disease complex

Seedling blight or damping-off occurs throughout Alberta. The disease usually results in the death of a proportion of seedlings every year causing an insignificant reduction in plant density. However, in some years the entire stand or large patches in the field may be killed and require reseeding. Seedling blight is most common when the crop is either sown too deep, into cold dry soil, or both.

Cause: Various fungi, primarily *Rhizoctonia solani*, *Fusarium* spp. and *Pythium* spp.

Symptoms: Seed or young seedlings may rot in the soil and fail to emerge indicating pre-emergence damping-off. Plants may emerge then suddenly collapse, or emerge and stagnate in the seedling or two to four leaf stage even when growing conditions appear favorable. This stage of the disease is known as post-emergence damping-off or seedling blight. The stems of infected seedlings appear water soaked or constricted at and below the soil line, and may be discolored reddish-brown. Although flea beetle damage may occur together with seedling blight, insect damage should not be mistaken for the disease if the seedings are dug up and examined. Flea beetles do not cause the seedling stem to rot off or constrict at or below the soil line.

Disease cycle: The causal fungi are soil-borne and may survive for years in the absence of a host. Plants may be attacked any time from germination until the two to four leaf stage. Infection usually occurs before or shortly after seedlings emerge from the soil. Environmental conditions that reduce seedling vigor, like cool temperatures and deep seeding, favor the pathogens and disease development. *Rhizoctonia* and *Fusarium* cause more damage in drier seedbeds whereas *Pythium* is usually favored by cool wet soils.

Cultural control: Avoid seeding deeper than 4 cm into cool soils. Seeding 1-2.5 cm into a firm, moist seedbed when soil temperature is above 10°C will result in vigorous emergence and reduce the period of seedling susceptibility. Fertilizer placed with the seed may delay or reduce emergence. No more than 10 kg N/ha or 20 kg P_2O_5/ha should be placed with the seed.

Chemical control: Seed treatment fungicide-insecticide combinations help protect the seedling during the emergence period and result in better stand establishment as shown in research trials conducted in Alberta. Consult the Alberta Agriculture factsheet *Seed Treatment of Cereal and Oilseed Crops* Agdex FS110/632 for a complete list of available seed treatments.

Staghead (white rust)

Just three years ago, staghead was a common disease of Polish canola varieties in Alberta. Yield losses as high as 20 per cent were recorded in some severely affected fields. Now the disease is found at much reduced levels where resistant varieties are grown.

Cause: A fungus, *Albugo candida*.

Symptoms: White to cream colored spots (pustules) may appear on the underside of leaves from the seedling stage onward. The most conspicuous symptom is the presence of swollen, twisted, and distorted flowers and flower stalks. These "stagheads" are green at first, becoming hard, dry and brown later in the season. They may be covered with white pustules or a white mealy growth during periods of wet weather.

Disease cycle: The pathogen overwinters as minute thick-walled spores that may be carried in staghead debris with the seed or from stagheads infesting the soil. In the spring these spores germinate, following heavy rains, and release 40-60 mobile spores that can infect young seedlings. Following infection, white pustules form on the underside of leaves. Pustules rupture to release chalk-like, air-borne spores that can spread the disease on the plant or to other plants causing leaf, stem and flower infections. Stagheads usually develop follow-

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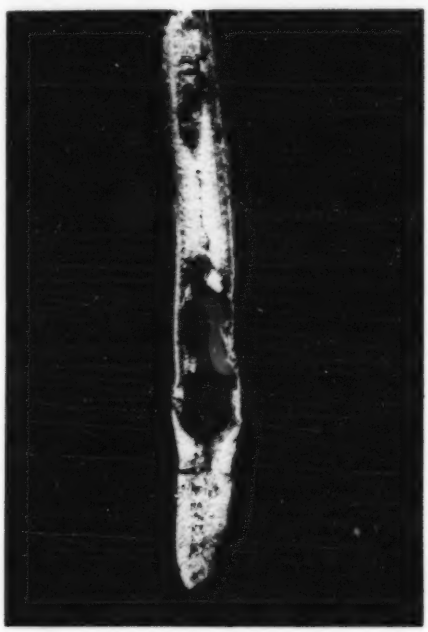
ing infection of young flower buds. Overwintering oospores form within stem blisters and stagheads and infest the seed when the crop is combined.

Cultural control: Rotate with non-susceptible crops such as cereals, and control volunteer canola and cruciferous weeds during the rotation. Stinkweed, marsh yellow cress, and wild mustard may carry strains of the fungus that can affect Polish type canola.

Resistant varieties: The variety Tobin is the first Polish type canola variety with resistance to staghead. Argentine type varieties such as Pivot, Triton and Westar are immune to all races of the disease currently found in western Canada.

Sclerotinia stem rot (white mold)

Stem rot occurs in all canola growing areas of Alberta. Recently it has been most severe in north central Alberta, particularly in the west. Yield losses of 15-40 per cent occur in heavily infected crops, but higher losses have been recorded. Wet weather and warm temperatures during the flowering period favor infection and disease development. Heavy and lodged crops suffer the greatest yield loss.



Sclerotia in infected canola stem.

Cause: A fungus, *Sclerotinia sclerotiorum.*

Symptoms: Pale grey stem lesions develop at or above the soil line or on upper branches and pods. Symptoms develop after flowering commences and are more common following periods of wet or humid weather. Plants with girdled stems ripen prematurely and stand out compared to green healthy plants. Stems on these plants appear bleached and tend to shred. Hard, black sclerotia or "sclerotes" may be found within infected stems, branches, or pods. Sclerotia vary in size and shape and may be small and spherical, about the size of canola seed, or long and cylinder shaped up to 2 cm.

Disease cycle: The disease overwinters as sclerotia in the soil or as contaminants with the seed. Given suitable moisture conditions, sclerotia may germinate producing tiny, golf-tee shaped mushrooms called apothecia. Apothecia produce spores that may be spread by wind currents up to a few kilometres from their source. Apothecia develop during periods of high soil moisture from late June onwards. Spore infection and disease development are greatest during periods of warm wet weather, following rains or periods of heavy dew.

New sclerotia are formed within infected stems, branches, and occasionally pods. Sclerotia are harvested with the seed when the crop is combined, others fall to the ground infesting the soil.

Cultural control: Sclerotinia is a difficult disease to control because it infects over 360 species of plants including many crops and broadleaved weeds. As well, sclerotia may persist for many years in the soil in the absence of a host.

Allow at least four years between susceptible crops like canola, field peas, beans, lentils and clovers. Control volunteer canola and broadleaved weeds during the rotation. Cereals and grasses are immune to *Sclerotinia sclerotiorum.* Do not seed canola adjacent to fields that were heavily infected the previous year.

Use clean seed free of sclerotia; only a spiral cleaner will remove the small seed-sized sclerotia from canola.

Chemical control: Significant and economic yield increases in Argentine type canola and to a lesser extent with Polish type canola have been obtained with the systemic fungicides benomyl (Benlate) and iprodione (Rovral) applied at the 20-30 per cent bloom stage. Specific information on chemical control of this disease is available in the "Canola Growers Manual" prepared by the Canola Council of Canada.

Blackleg

A mild or avirulent form of blackleg occurs in all canola producing areas of the province and is rarely associated with any yield loss. However, an aggressive or virulent form of the disease was found on the eastern border of Alberta in 1983 and the area infested has increased since then. In 1986, the disease was common along the Saskatchewan border. This strain of the disease has caused yield reductions of up to 50 per cent in Saskatchewan, and is a serious problem in Manitoba as well. A survey is conducted annually by plant pathologists from Alberta Agriculture, Agriculture Canada, and the University of Alberta to follow the extent of the disease in the province and evaluate any yield loss.

Cause: A fungus, *Leptosphaeria maculans*.

Symptoms: In the mild strain buff colored, round to irregular leaf spots that are dotted with numerous pepperlike, black fruiting bodies appear during the summer. Later in the season shallow white to grey-black lesions, typical of the mild strain, may occur at the base of the stem or on other above-ground plant tissues.

In contrast, the virulent strain of the fungus infects the plants much earlier in the season. Leaf spots may appear from the seedling stage onward, and stem infection before the six leaf stage. This early infection is usually associated with serious yield loss. Following stem infection, a severe grey to black basal stem canker develops, girdling the stem and causing the canola to lodge.

Disease cycle: The fungus overwinters on crop stubble and within and on infected seed. In areas where the virulent strain is established, seed infection is of little importance in disease development. Infected seed provides an effective means of long distance dispersal and is a likely method of introduction into the province and spread within the province.

Air-borne spores from infected stubble of previous crops start the first infections in the field. White to buff colored leaf spots develop and within them are numerous fruiting bodies that produce a second spore type. Spores from infected plants can be carried by wind for 3 km or more to nearby fields. Rain splash can spread the disease on the plant and to adjacent plants. Seeds produced within diseased pods may be infected. These infested seeds can introduce the disease to virulent blackleg-free areas.

Wild mustard (*Sinapis arvensis*) is the only important weed host of the virulent strain of blackleg.

Cultural control: Rotation is an important form of disease management. Severe yield losses from the virulent strain have only occurred where canola was planted on or adjacent to a field in which the disease had occurred the previous year. Spores are produced on infected stubble for at least two years or until the residue is decomposed. Burial of infected canola trash appears to be an effective method of control. Control volunteer canola and cruciferous weeds during the rotation.

Resistant varieties: None. Resistant lines are currently being used in a canola breeding program at Saskatoon.

Chemical control: Seed treatments containing the systemic fungicides benlate, carbathiin or iprodione will control the seed-borne stage of blackleg. A known seed source and seed treatment with fungicide is our defence against increased spread of this disease within Alberta. Detailed information on this disease is available in a factsheet "Blackleg of Canola" Agdex 149/632-3.

Root rot complex

This disease is a major problem in the Peace River region where some fields may have 80-100 per cent of its plants infected. Damage is usually greatest when wet soil conditions occur at the onset of flowering, followed by dry weather later in the season.

Cause: *Rhizoctonia solani, Fusarium* spp. *Pythium* sp.

Symptoms and disease cycle: Light brown lesions develop on the taproot and lateral roots usually at or following the onset of flowering. Lesions become sunken and darker and may enlarge to girdle the taproot resulting in premature death of the plants. Girdled plants may have only a short stub of the taproot remaining and are subject to dessication and lodging. Losses are greatest when high temperatures and dry windy conditions follow root damage. Yield loss may exceed 50 per cent.

Cultural control: Avoid seeding deeper than 4 cm into cool soil. Shallow planting reduces root rot. A complete fertilizer application (N, P and K) to encourage good plant health reduces damage caused by root rot. Avoid planting canola in heavy clay soils, if possible.

Resistant varieties: Argentine type canola appears to have some resistance to this disease and should be grown where climatic conditions are suitable.

Chemical control: None.

Alternaria black spot (grey leaf spot)

Grey leaf spot occurs wherever canola is grown in Alberta. Generally the disease is more prevalent in the Peace River region and north-central Alberta where moisture and temperature conditions are more favorable for infection and disease development. Significant yield loss may occur when canola is sown on or adjacent to diseased stubble. Periods of warm wet weather favors the pathogen.

Cause: Two fungi, *Alternaria brassicae* and *A. raphani*.

Symptoms: Infected seed may rot in the ground or produce seedlings with dark spots on the coytledons or seed leaves. All above-ground plant parts are susceptible to infection. Leaf spots range from grey to black depending on environmental conditions. Stem and pod lesions first appear as small brown or black dots and may be black or greyish-white with dark borders. Infected pods may ripen prematurely and shatter before the crop is mature. Pod shatter is the main cause of yield loss.

Disease cycle: The fungi overwinter on infected crop trash, in infected seedlots, and on winter annual weed hosts like stinkweed. Spores are produced in the spring and dispersed by wind to the new crop. During periods of leaf wetness, spores germinate and infect the plants causing leaf spots. New spores are produced on diseased plants and infection cycles continue throughout the summer when environmental conditions are suitable. Seed below sunken pod spots is often infected.

Cultural control: Follow a crop rotation at least three years between cruciferous crops and control volunteer canola and cruciferous weeds during rotation. Incorpor-

ate infected stubble into the soil if canola will be sown on adjacent land the following year. Use well-cleaned seed with germination over 90 per cent.

Resistant varieties: None. Argentine type canola is less susceptible to alternaria leaf spot than Polish varieties.

Chemical control: None.

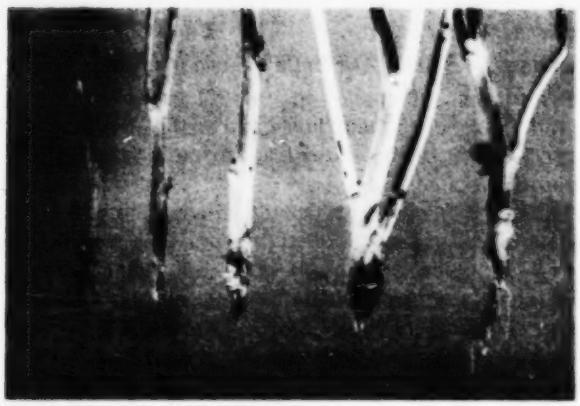
Foot rot

Foot rot occurs sporadically in canola crops throughout Alberta. The disease has not been associated with major yield losses in recent years. However, it is increasing in incidence and severity in other parts of western Canada.

Cause: Several fungi, primarily *Fusarium* spp., *Rhizoctonia solani*, and *Pythium* spp.

Symptoms and disease cycle: During the summer, scattered plants or patches of prematurely ripened plants appear in the crop. Hard, brown, clearly defined lesions occur at the base of the stem and pink spore masses may be apparent during periods of wet weather.

The fungi that cause foot rot are all soil-borne and may persist for years in the soil in the absence of a host. Canker or lesion development may be favored by high soil temperatures or wounds caused by insect feeding. Because foot rot develops quite late in the season, the earlier maturing Polish type canola varieties may escape infection, or lesions may not have time to develop to the point that yield is seriously reduced.



Foot and root rot of canola.

Cultural control: Allow at least three years between canola crops and control volunteer canola and cruciferous weeds during the rotation.

Resistant cultivars: None.

Chemical control: None.

Greystem and white leaf spot

Greystem is prevalent late in the growing season in most canola production areas, however, it usually develops **too late to significantly** affect crop yields. The disease may occur earlier in crops under stress from lack of moisture, insufficient nitrogen, or heavy competition from weeds.

Cause: A fungus, *Pseudocercosporella capsellae*.

Symptoms: White leaf spot appears in early summer. As the crop ripens large purple to grey speckled stem and pod lesions develop. At harvest time some plants may be entirely discolored and the field may appear purple or grey.

Disease cycle: The fungus overwinters on diseased crop stubble and produces spores the following spring. Spores are carried by wind currents into the crop and infection causes white leaf spots to develop. Late in the season a second period of spore production occurs and causes rapid disease development on the ripening crop.

Pseudocercosporella capsellae has a wide host range among common cruciferous weeds including ball mustard, shepherd's purse and hare's-ear mustard.

Cultural control: Rotation with noncruciferous crops and control of volunteer canola and cruciferous weeds should reduce the level of infection in the crop.

Aster yellows

Aster yellows occurs sporadically and is considered a disease of minor importance in Alberta.

Cause: Aster yellows is a mycoplasm-like organism.

Symptoms: A typical symptom of the disease is the formation of small, blue-green, hollow bladders in the place of normal pods. Normal pods may be present on lower portions of the plant. Affected plants remain green and continue to flower after the crop ripens. Less than 1 per cent of the crop is usually affected in most years.

Disease cycle: Aster yellows is spread from plant to plant by the six-spotted leafhopper. Disease severity varies with the abundance of the leafhopper vector. Nearly 300 species of plants are susceptible to this disease including many field crops.

Control: None.

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